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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/039,036	01/04/2002	Nicholas P. Wilt	MSFT-0742/177739.1	2352

41505 7590 11/16/2005	EXAMINER
WOODCOCK WASHBURN LLP (MICROSOFT CORPORATION) ONE LIBERTY PLACE - 46TH FLOOR PHILADELPHIA, PA 19103	ALI, SYED J

ART UNIT	PAPER NUMBER
2195	

DATE MAILED: 11/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)
Office Action Summary	10/039,036	WILT ET AL.
	Examiner	Art Unit	
	Syed J. Ali	2195	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *16 September 2005*.

2a) ☒ This action is **FINAL**.   2b) ☐ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-23,27-49 and 52-74* is/are pending in the application.

　　4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1-23,27-49 and 52-74* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on *16 September 2005* is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.

　　Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

　　Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

　　a) ☐ All　b) ☐ Some * c) ☐ None of:

　　　1. ☐ Certified copies of the priority documents have been received.

　　　2. ☐ Certified copies of the priority documents have been received in Application No. _____.

　　　3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

　　* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
　　Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
　　Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1.   This office action is in response to the amendment filed September 16, 2005. Claims 1-

23, 27-49, and 52-74 are presented for examination.

2.   The text of those sections of Title 35, U.S. code not included in this office action can be

found in a prior office action.

Claim Rejections - 35 USC § 103

3.   **Claims 1-13, 16-23, 27-39, 42-49, 52-64, and 67-74 are rejected under 35 U.S.C.**

103(a) as being unpatentable over Anderson et al. (USPN 5,577,250) (hereinafter Anderson)

in view of Duruoz et al. (USPN 6,487,642) (hereinafter Duruoz).

4.   As per claim 1, Anderson teaches the invention as claimed, including a method for

controlling the computational resources of at least one coprocessor in a host computing system

having a host processor (col. 1 lines 11-14), comprising:

controlling the at least one coprocessor of the computing system with commands

submitted to the at least one coprocessor by a host processor of the host computing system (col. 6

lines 64-67; col. 7 lines 6-12);

transmitting, by the at least one coprocessor, data back to the host computing system in

response to commands (col. 10 lines 6-17); and

scheduling the transmission of the commands included in the host computing system (col.

7 lines 36-41; col. 10 lines 6-17),

wherein the computational resources of the at least one coprocessor are simultaneously available to a plurality of applications instantiated on the host computing system (col. 5 lines 33-38).

5.   Duruoz teaches the invention as claimed, including using a managing object to submit commands to command buffers associated with the coprocessor (Fig. 3; col. 2 lines 32-46).

6.   It would have been obvious to one of ordinary skill in the art to combine Anderson and Duruoz since buffering commands instead of requiring immediate execution allows the host processor to continue in other tasks without waiting for the coprocessor to complete its commands. This allows other tasks with hard deadlines to be completed on time, creating a pipelined system of processing that allows more tasks to be serviced in the same period of time.

7.   As per claim 2, Duruoz teaches the invention as claimed, including a method according to claim 1, wherein said scheduling includes scheduling the transmission of the commands of the command buffers by an operating system included in the host computing system (col. 6 line 67 - col. 7 line 4).

8.   As per claim 3, Duruoz teaches the invention as claimed, including a method according to claim 1, wherein the managing object is notified by a coprocessor that commands of a command buffer has finished execution (col. 5 lines 57-63).

9.   As per claim 4, Duruoz teaches the invention as claimed, including a method according to claim 1, further including queuing commands of a new command buffer for a coprocessor to begin executing when commands of a current command buffer are finished (Fig. 3; col. 2 lines 32-46).

10.   As per claim 5, Duruoz teaches the invention as claimed, including a method according to claim 1, further including specifying a coprocessor context switch when commands of a command buffer is submitted (col. 7 line 66 - col. 8 line 13).

11.   As per claim 6, Duruoz teaches the invention as claimed, including a method according to claim 1, wherein said managing object allows a plurality of types of coprocessor context (col. 8 line 64 - col. 9 line 8).

12.   As per claim 7, Duruoz teaches the invention as claimed, including a method according to claim 6, further including affiliating coprocessor context with a host processor thread context (col. 8 lines 56-63).

13.   As per claim 8, Duruoz teaches the invention as claimed, including a method according to claim 7, further including integrating by the managing object the context switching code for the host processor and the coprocessor (col. 8 line 56 - col. 9 line 8).

14.   As per claim 9, Duruoz teaches the invention as claimed, including a method according to claim 1, further including notifying the managing object by a coprocessor that commands of a command buffer are invalid (col. 8 lines 28-34).

15.   As per claim 10, Duruoz teaches the invention as claimed, including a method according to claim 1, further including resetting a coprocessor of the at least one coprocessor if the coprocessor is unresponsive for a predetermined period of time (col. 20 lines 60-66).

16.   As per claim 11, Duruoz teaches the invention as claimed, including a method according to claim 1, further including translating by a hardware-specific driver object, via an application programming interface of the managing object, instructions of commands of a command buffer into hardware-specific instructions during composition of the commands of the command buffer (col. 6 line 16 - col. 7 line 17).

17.   As per claim 12, Duruoz teaches the invention as claimed, including a method according to claim 11, wherein said translating runs in user mode (col. 6 line 16 - col. 7 line 17).

18.   As per claim 13, Duruoz teaches the invention as claimed, including a method according to claim 12, further including allocating a guard page at the end of the commands of the command buffer to facilitate efficient detection of buffer overflow (Fig. 3; col. 2 lines 32-46, wherein management of overflow is a well-known technique of buffering to prevent data from being dropped).

19.   As per claim 16, Anderson teaches the invention as claimed, including a method according to claim 12, wherein said driver object coordinates with a corresponding kernel mode driver object to edit the commands of the command buffer before submission to hardware (col. 7 lines 6-18).

20.   As per claim 17, Anderson teaches the invention as claimed, including a method according to claim 1, wherein the at least one coprocessor includes at least one graphics processing unit (col. 1 lines 18-20).

21.   As per claim 18, Anderson teaches the invention as claimed, including a method according to claim 1, further including preempting by the at least one coprocessor upon the occurrence of an external event (col. 7 lines 41-55).

22.   As per claim 19, Anderson teaches the invention as claimed, including a method according to claim 18, wherein the external event is the operating system making a call to a corresponding kernel mode driver object to preempt the at least one coprocessor (col. 7 lines 41-55).

23.   As per claim 20, Duruoz teaches the invention as claimed, including a method according to claim 18, wherein the host processor is interrupted to coordinate scheduling of processing time (col. 6 line 66 - col. 7 line 4).

24.   As per claim 21, Duruoz teaches the invention as claimed, including a method according to claim 1, further including virtualizing by the managing object at least one resource of the at least one coprocessor during editing of the control data streams of a command buffer before submission to a coprocessor (col. 2 lines 3-13, 32-46).

25.   As per claim 22, Duruoz teaches the invention as claimed, including a method according to claim 21, wherein the at least one resource virtualized by the managing object of the at least one coprocessor is a memory (Fig. 12; col. 8 line 56 - col. 9 line 8).

26.   As per claim 23, Duruoz teaches the invention as claimed, including a method according to claim 1, wherein the managing object uses thread synchronization primitives to coordinate the construction, scheduling, and submission of the commands of coprocessor command buffers (col. 6 line 66 - col. 7 line 17; col. 8 lines 24-36).

27.   As per claim 27-39 and 42-49, Anderson teaches the invention as claimed, including at least one computer readable medium having stored thereon a plurality of computer-executable modules for performing the method of claims 1-13 and 16-23, respectively (Fig. 1).

28.   As per claim 52-64 and 67-74, Anderson teaches the invention as claimed, including a computing device for performing the method of claims 1-13 and 16-23, respectively (Fig. 1).

29.   **Claims 14-15, 40-41, and 65-66 are rejected under 35 U.S.C. 103(a) as being**

unpatentable over Anderson in view of Duruoz in view of Hendler et al. (USPN 6,473,777)

(hereinafter Hendler).

30.   As per claim 14, Hendler teaches the invention as claimed, including a method according

to claim 12, wherein the user mode driver and corresponding runtime component are provided in

intermediate language form and the method further includes just in time (JIT) compiling on a

client device having the user mode driver and runtime component (col. 3 lines 29-63).

31.   It would have been obvious to one of ordinary skill in the art to combine Anderson and

Duruoz with Hendler since the offloading of certain processing to a coprocessor allows the host

to continue performing other tasks, while allowing more computationally intensive tasks to be

handled by a dedicated processor. Just-in-time compiling incurs a great deal of overhead and

could bog a system down. By dedicating a coprocessor to perform such a function, the system as

a whole can operate more efficiently.

32.   As per claim 15, Hendler teaches the invention as claimed, including a method according

to claim 14, wherein the application is also provided in intermediate language form and said JIT

compiling includes JIT compiling the application on the client device with at least the user mode

driver (col. 3 lines 29-63).

33.   As per claim 40-41, Anderson teaches the invention as claimed, including at least one

computer readable medium having stored thereon a plurality of computer-executable modules for

performing the method of claims 14-15, respectively (Fig. 1).

34.   As per claim 65-66, Anderson teaches the invention as claimed, including a computing

device for performing the method of claims 14-15, respectively (Fig. 1).

Response to Arguments

35.   **Applicants' arguments filed September 16, 2005 have been fully considered but they
are not persuasive.**

36.   Applicants argue that the preceding Office Action did not respond to Applicants' claim

language. Specifically, the argument is presented that the following limitation of representative

claim 1 is not addressed: "transmitting, by the at least one coprocessor, data back to the host

computing system **in response to commands in at least one command buffer of the command**

buffers." (Applicants' emphasis). Applicant submits that the Office Action does not address the

tail end of the limitation, that the response is to commands stored in the command buffer.

37.   In responding to this argument, it is believed necessary to address Examiner's

understanding of what this limitation conveys, as it seems to differ from the meaning attached by

Applicants. The preceding limitation, i.e. "controlling the at least one coprocessor", is relevant

to the meaning attached to the "transmitting" limitation. First, a host processor submits

commands to a coprocessor, the commands being stored in a command buffer. The coprocessor

then performs some amount of processing in response to the commands stored in the command buffer. The output of this processing is then transmitted back to the host computing system. The transmission is in response to the processing of the commands in the command buffer performed by the coprocessor. On the other hand, Applicants seem to believe this limitation indicates that the coprocessor transmits its output to another command buffer, wherein the host computing system then handles the output data in this second command buffer.

It is Examiner's contention that the claim language does not reflect the meaning attached by Applicants. The limitation is clear in indicating that the transmitting step is performed **by the at least one coprocessor**. The coprocessor is performing the "response" step, and transmits data **to** the host computing system. How the host computing system handles the response data and what happens to the data after the host computing system receives it is outside the scope of the claim. Thus, when the DSP (coprocessor) of Anderson outputs data to the speaker, it is transmitting data back to the host computing system in response to a received command. It has been noted that Anderson does not specifically indicate that the coprocessor pulls commands from a command buffer. This is what Duruoz is cited as teaching, i.e. a command buffer storing commands for a coprocessor. The combination thereof teaches the claim limitation, with Anderson transmitting data back to the host computing system in response to a received command, with Duruoz showing how the efficiency of the system can be improved if a command buffer is included with the coprocessor.

38.   Applicants also attack the motivation to combine Anderson and Duruoz, relying on the argument that a prima facie case of obviousness requires a "teaching, suggestion, or motivation"

to do so. This motivation can be found either explicitly or implicitly in the references, or in the knowledge generally available to one of ordinary skill in the art. Applicants submit that Anderson teaches away from the use of a command buffer by requiring "immediate execution of commands", as allegedly admitted in the Office Action.

39.   Applicants' argument is deficient for several reasons. First, nowhere has the Office Action conceded that Anderson requires immediate execution of commands. In fact, it is arguable that Anderson teaches a form of command buffer, in that an input FIFO (first-in-first-out) buffer exists for storing data to be used in executing the coprocessor application (col. 10 lines 7-17; Fig. 6). However, the FIFO buffer as disclosed in Anderson stores **data**, not "commands" per se. Thus, in an effort to demonstrate why a command buffer storing commands, instead of merely data, would have been obvious, Duruoz was cited and the teachings of Anderson's FIFO were not mentioned to avoid confusion. That Anderson performs processing using data buffers should be dispositive evidence that Anderson does not teach away from using a command buffer, as immediate execution is clearly not required. A FIFO buffer would be absolutely useless if it was required.

Even if Applicants accept Examiner's argument that Anderson does not teach away from the combination with Duruoz, it is conceded by Examiner that valid motivation to combine is required for a prima facie case of obviousness. In the original Office Action, the knowledge generally available to a person having ordinary skill in the art was relied upon. This motivation is still believed valid, and reiterated above in paragraph 6. Nonetheless, to make it explicitly clear just how obvious this combination is, attention is directed to the Abstract of Duruoz, which discusses several advantages of using a command buffer. Generally, these advantages are

similar to those relied upon as being within the general knowledge of a person of ordinary skill originally relied upon by Examiner. These advantages include: (1) the host need not wait for the command to be executed; (2) sorting commands so that time-critical commands are executed appropriately; (3) scheduling nonexclusive commands at the appropriate time; (4) allowing for prioritization of nonexclusive commands, etc. (Duruoz, Abstract). Thus, there is ample motivation to combine Anderson and Duruoz.

Conclusion

40.   **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Syed J. Ali whose telephone number is (571) 272-3769. The examiner can normally be reached on Mon-Fri 8-5:30, 2nd Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Meng-Ai T. An can be reached on (571) 272-3756. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Syed Ali
November 11, 2005

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